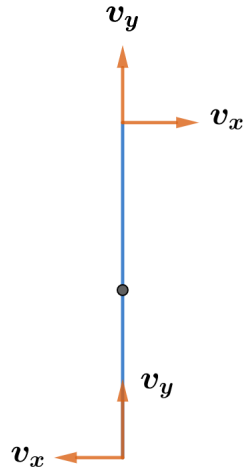


2019A F=ma Exam: Problem 15

Kevin S. Huang



We can decompose the motion of the rod into translation of its center of mass and rotation about its center of mass. From kinematics, the time it takes the rod to land is

$$v_y - gT = -v_y$$
$$T = \frac{2v_y}{g}$$

In the center of mass frame, the rod rotates with angular velocity

$$\omega = \frac{v_x}{L/2}$$

To complete a revolution by the time the rod lands, we have

$$\omega = \frac{2\pi}{T}$$
$$\frac{v_x}{L/2} = \frac{2\pi}{2v_y/g}$$

so

$$\boxed{v_x = \frac{\pi l g}{2v_y}}$$